CLAIMS

What is claimed is:

1.   A method comprising:

     identifying network elements at endpoints of a data connection channel;

     generating a candidate path between the network elements at the endpoints;

     validating the candidate path by determining whether the candidate path provides at least a service requirement selected from a group consisting of minimum bandwidth, maximum bandwidth, maximum delay, maximum jitter, reliability, inclusion of network elements capable of acting as security gateways that bracket untrusted sections of the candidate path, reachability, and data collection capability; and

     configuring network elements along a validated candidate path to implement the service requirement.

2.   The method of claim 1, further comprising:

     identifying network elements at endpoints of a plurality of data connection channels;

     for each data connection channel, generating at least one candidate path between the network elements at the endpoints of the data connection channel;

     for each candidate path, validating the candidate path by determining whether the candidate path provides at least a service requirement selected from a group consisting of minimum bandwidth, maximum bandwidth, maximum delay, maximum jitter, reliability, inclusion of network elements capable of acting as security gateways that bracket untrusted sections of the candidate path, reachability, and data collection capability; and

12 configuring network elements along validated candidate paths to implement

13 service requirements.

1 3. The method of claim 1, further comprising recording a configuration performed

2 on the network elements.

1 4. The method of claim 1, further comprising:

2 identifying data connection channels that have been provisioned to implement a

3 service;

4 for each data connection channel, identifying a path followed by the data

5 connection channel and a configuration performed to implement the service at network

6 elements along the path;

7 undoing the configuration performed to implement the service at the network

8 elements along the path; and

9 removing a recording of the configuration performed to implement the service

10 on the network elements along the path.

1 5. The method of claim 1, further comprising:

2 identifying a change in a routing table entry;

3 identifying data connection channels provisioned on a data link connected to an

4 interface referenced by the routing table entry prior to the change;

5 for each data connection channel provisioned on the data link, identifying

6 whether the data connection channel is affected by the change;

7 for each data connection channel affected by the change, de-provisioning the

8 data connection channel affected by the change; and

9   for each data connection channel affected by the change, re-provisioning the

10   data connection channel affected by the change.

1   6.   The method of claim 1, wherein generating a candidate path between the

2   network elements at the endpoints further comprises assigning to a link in a graph that

3   is not in a preferred area of a network a weight that is different than a weight assigned

4   to a link in the graph that is in a preferred area of the network.

1   7.   The method of claim 6, wherein assigning to a link in a graph that is not in a

2   preferred area of a network a weight that is different than a weight assigned to a link in

3   the graph that is in a preferred area of the network further comprises adjusting a weight

4   assigned to a link in the graph depending on a proportion of usage of available

5   bandwidth of the link.

1   8.   The method of claim 7, wherein adjusting a weight assigned to a link in the

2   graph depending on a proportion of usage of available bandwidth of the link further

3   comprises:

4   adjusting a weight assigned to a link in the graph having lighter usage relative to

5   other links in the graph to a weight indicating a greater preference; and

6   adjusting a weight assigned to a link in the graph having heavier usage relative

7   to other links in the graph to a weight indicating a lesser preference.

1   9.   The method of claim 7, wherein adjusting a weight assigned to a link in the

2   graph depending on a proportion of usage of available bandwidth of the link further

3   comprises:

4   adjusting a weight assigned to a link in the graph having heavier usage relative

5   to other links in the graph to a weight indicating a greater preference; and

6   adjusting a weight assigned to a link in the graph having lighter usage relative to

7   other links in the graph to a weight indicating a lesser preference.

1   10.   A method for a provisioning system comprising:

2   a) identifying a candidate path for a newly requested service, the newly requested

3   service having a service description, wherein the newly requested service is in an

4   Internet Protocol (IP) network, the IP network having a plurality of routers, wherein

5   the identified candidate path travels through a set of the plurality of routers;

6   b) determining whether the set of the plurality of routers can be configured to meet

7   a set of requirements specified by the service description; and

8   c) if the set of the plurality of routers are determined to meet the set of

9   requirements, then translating the set of requirements into a corresponding set of

10   router management commands to configure each router in the set of the plurality of

11   routers.

1   11.   The method of claim 10, further comprising:

2   d) identifying a plurality of candidate paths for a newly requested service, the newly

3   requested service having a service description, wherein the newly requested service

4   is in an Internet Protocol (IP) network, the IP network having a plurality of routers,

5   wherein each candidate path of the plurality of candidate paths travels through a

6   subset of the plurality of routers;

7   e) for each candidate path, determining whether a subset of the plurality of routers

8   can be configured to meet a set of requirements specified by the service description;

9   and

10   f) for each set of requirements, if a subset of the plurality of routers are determined

11   to meet the set of requirements, then translating the set of requirements into a

12   corresponding set of router management commands to configure each router in the

13   subset of the plurality of routers.

1   12.   The method of claim 10, wherein the set of requirements includes one or more

2   of quality of service, security, reachability, and data collection specifications.

1   13.   The method of claim 10, further comprising:

2   if the identified candidate path cannot fulfill the set of requirements and there

3   are other untried candidate paths, then identifying a different candidate path and

4   repeating steps b) and c).

1   14.   The method of claim 10, wherein the translating includes querying a network

2   topology database to determine the capabilities of each router of the plurality of routers.

1   15.   A method for a provisioning system comprising:

2   identifying a set of one or more candidate paths for a newly requested service in

3   an Internet Protocol (IP) network having a plurality of routers, wherein each of the

4   candidate paths travels through a different subset of the plurality of routers, the

5   newly requested service having a service description;

6   eliminating a candidate path from the set of candidate paths whose

7   corresponding subset of the plurality of routers cannot be configured to meet the set

8   of requirements specified by the service description; and

9   translating a remaining candidate path into a set of router management

10   commands to configure the subset of the plurality of routers.

1   16.   The method of claim 15, wherein the set of requirements includes one or more

2   of quality of service, security, and data collection specifications.

1   17.   The method of claim 15, wherein the identifying includes querying a

2   provisioned services database to add together the bandwidth commitments of

3   previously deployed services to determine if each of the candidate paths has sufficient

4   uncommitted bandwidth for the newly requested service.

1   18.   A provisioning system comprising:

2   a provisioning engine coupled to a network topology database and a provisioned

3   services database, the provisioning engine to identify candidate paths for newly

4   requested services in a network, each of the newly requested services having a

5   corresponding service description that specifies a corresponding set of requirements,

6   wherein each of the candidate paths are to include a subset of routers of a plurality of

7   routers in the network, wherein the provisioning engine is to determine whether a set of

8   the candidate paths meet the corresponding set of requirements; and

9   a translation module coupled to the provisioning engine, the translation module

10   to translate the set of requirements for a set of candidate paths that meet the

11   corresponding set of requirements, the translation to generate corresponding router

12   management commands to configure routers in the plurality of routers.

1   19.   The provisioning system of claim 18, wherein the set of requirements includes

2   one or more of quality of service, security, and data collection specifications.

1　20.　The provisioning system of claim 18, wherein the translation module is to store

2　the configuration of the routers in the provisioned services database.

1　21.　A machine-readable medium that provides instructions that, when executed by a

2　machine, cause the machine to perform operations comprising:

3　　　identifying network elements at endpoints of a data connection channel;

4　　　generating a candidate path between the network elements at the endpoints;

5　　　validating the candidate path by determining whether the candidate path

6　provides at least a service requirement selected from a group consisting of minimum

7　bandwidth, maximum bandwidth, maximum delay, maximum jitter, reliability,

8　inclusion of network elements capable of acting as security gateways that bracket

9　untrusted sections of the candidate path, and data collection capability; and

10　　　configuring network elements along a validated candidate path to implement the

11　service requirement.

1　22.　The machine-readable medium of claim 21, wherein operations further

2　comprise:

3　　　identifying network elements at endpoints of a plurality of data connection

4　channels;

5　　　for each data connection channel, generating at least one candidate path

6　between the network elements at the endpoints of the data connection channel;

7　　　for each candidate path, validating the candidate path by determining whether

8　the candidate path provides at least a service requirement selected from a group

9　consisting of minimum bandwidth, maximum bandwidth, maximum delay, maximum

10　jitter, reliability, inclusion of network elements capable of acting as security gateways

11   that bracket untrusted sections of the candidate path, reachability, and data collection

12   capability; and

13   configuring network elements along validated candidate paths to implement

14   service requirements.

1   23.   The machine-readable medium of claim 21, wherein operations further

2   comprise recording a configuration performed on the network elements.

1   24.   The machine-readable medium of claim 21, wherein operations further

2   comprise:

3   identifying data connection channels that have been provisioned to implement a

4   service;

5   for each data connection channel, identifying a path followed by the data

6   connection channel and a configuration performed to implement the service at network

7   elements along the path;

8   undoing the configuration performed to implement the service at the network

9   elements along the path; and

10   removing a recording of the configuration performed to implement the service

11   on the network elements along the path.

1   25.   The machine-readable medium of claim 21, wherein operations further

2   comprise:

3   identifying a change in a routing table entry;

4   identifying data connection channels provisioned on a data link connected to an

5   interface referenced by the routing table entry prior to the change;

6   for each data connection channel provisioned on the data link, identifying

7   whether the data connection channel is affected by the change;

8   for each data connection channel affected by the change, de-provisioning the

9   data connection channel affected by the change; and

10   for each data connection channel affected by the change, re-provisioning the data

11   connection channel affected by the change.

1   26.   The machine-readable medium of claim 21, wherein operations further

2   comprise assigning to a link in a graph that is not in a preferred area of a network a

3   weight that is different than a weight assigned to a link in the graph that is in a

4   preferred area of the network.

1   27.   The machine-readable medium of claim 26, wherein assigning to a link in a

2   graph that is not in a preferred area of a network a weight that is different than a weight

3   assigned to a link in the graph that is in a preferred area of the network further

4   comprises adjusting a weight assigned to a link in the graph depending on a proportion

5   of usage of available bandwidth of the link.

1   28.   The machine-readable medium of claim 27, wherein adjusting a weight

2   assigned to a link in the graph depending on a proportion of usage of available

3   bandwidth of the link further comprises:

4   adjusting a weight assigned to a link in the graph having lighter usage relative to

5   other links in the graph to a weight indicating a greater preference; and

6   adjusting a weight assigned to a link in the graph having heavier usage relative

7   to other links in the graph to a weight indicating a lesser preference.

1   29.   The machine-readable medium of claim 27, wherein adjusting a weight

2   assigned to a link in the graph depending on a proportion of usage of available

3   bandwidth of the link further comprises:

4   adjusting a weight assigned to a link in the graph having heavier usage relative

5   to other links in the graph to a weight indicating a greater preference; and

6   adjusting a weight assigned to a link in the graph having lighter usage relative to

7   other links in the graph to a weight indicating a lesser preference.

1   30.   A machine-readable medium that provides instructions that, when executed by a

2   machine, cause the machine to perform operations comprising:

3   a) identifying a plurality of candidate paths for a plurality of newly requested

4   services, each one of the newly requested services having a service description,

5   wherein the newly requested services are in an Internet Protocol (IP) network, the

6   IP network having a plurality of routers, wherein the identified candidate path

7   travels through a subset of the plurality of routers;

8   b) for each service description, determining whether the subset of the plurality of

9   routers can be configured to meet a set of requirements specified by the service

10   description; and

11   c) for each set of requirements, if the subset of the plurality of routers are

12   determined to meet the set of requirements, then translating the set of requirements

13   into a corresponding set of router management commands to configure each router

14   in the subset of the plurality of routers.

1   31.   The machine-readable medium of claim 30, wherein operations further

2   comprise:

3   d) identifying a plurality of candidate paths for a plurality of newly requested

4   services, each one of the newly requested services having a service description,

5   wherein the newly requested services are in an Internet Protocol (IP) network, the

6   IP network having a plurality of routers, wherein the identified candidate path

7   travels through a subset of the plurality of routers;

8   e) for each service description, determining whether the subset of the plurality of

9   routers can be configured to meet a set of requirements specified by the service

10   description; and

11   f) for each set of requirements, if the subset of the plurality of routers are

12   determined to meet the set of requirements, then translating the set of requirements

13   into a corresponding set of router management commands to configure each router

14   in the subset of the plurality of routers.

1   32.   The machine-readable medium of claim 30, wherein the set of requirements

2   includes one or more of quality of service, security, and data collection specifications.

1   33.   The machine-readable medium of claim 30, wherein operations further

2   comprise:

3   if the identified candidate path cannot fulfill the set of requirements and there

4   are other untried candidate paths, then identifying a different candidate path and

5   repeating steps b) and c).

1   34.   The machine-readable medium of claim 30, wherein the translating includes

2   querying a network topology database to determine the capabilities of each router of the

3   plurality of routers.

35. A machine-readable medium that provides instructions that, when executed by a machine, cause the machine to perform operations comprising:

identifying a set of one or more candidate paths for a newly requested service in an Internet Protocol (IP) network having a plurality of routers, wherein each of the candidate paths travels through a different subset of the plurality of routers, the newly requested service having a service description;

eliminating a candidate path from the set of candidate paths whose corresponding subset of the plurality of routers cannot be configured to meet the set of requirements specified by the service description; and

translating a remaining candidate path into a set of router management commands to configure the subset of the plurality of routers.

36. The machine-readable medium of claim 35, wherein the set of requirements includes one or more of quality of service, security, and data collection specifications.

37. The machine-readable medium of claim 35, wherein the identifying includes querying a provisioned services database to add together the bandwidth commitments of previously deployed services to determine if each of the candidate paths has sufficient uncommitted bandwidth for the newly requested service.